REMARKS

Claims 1-4, 6, 7, 10, 13-39 and 42 were rejected under 35 U.S.C. 103(a) as being unpatentable over Ehrlich et al. ('904) in view of van Der Wal et al. ('445) and Mao ('572). This rejection is respectfully traversed by the current amendment and the arguments presented below. The Examiner is requested to reconsider the rejection and allow the amended claims.

The claims have been amended to include claim 2 in claim 1. The comparative experiments in the Examples show the unexpected nature of the thermoplastic polyurethane made according to the amended claims. Claim 2 has been cancelled as it is now included in claim 1.

In the present invention, the objective is to make a TPU which can be processed fast and with good control of thickness in coated fabric applications, such as conveyor belt manufacture. Applicants have determined that to achieve this objective, the thermoplastic polyurethane needs to have slow annealing, low sensitivity of the complex viscosity to changes in shear rates, reduced crystallinity, and good hydrolytic resistance in the final product. To arrive at a combination of all of these properties, Applicants invented a thermoplastic polyurethane which is made with a mixture of polyols (a polyester and poly(tetramethylene ether glycol), which is a polyether polyol). Also a blend of chain extenders is required. One chain extender must be symmetrical while the second chain extender must be asymmetric or of a different chain length. The Applicants unexpectedly found that this combination of reactants, when used in the proportions recited in the claims will achieve all of the objectives desired.

The Examiner's attention is directed to the Examples in Table 1 of the present specification. Several control Examples are presented, which are closer to the claimed invention than the prior art cited. Examples 1 and 4 are controls which use a single polyol (polyester) along with the unique mixed chain extenders. Examples 6 and 7 are controls which use a mixture of polyols but only 1 chain extender. Examples 8 and 11 use a single polyol with the unique mixture of chain extenders. Example 15 uses 1 polyol and 1 chain extender, and as such

is a typical TPU. These Examples when compared to the Examples of the invention offer a very compelling non-obvious solution to the problem the inventors are trying to solve. Only the Examples which use a certain level of PTMEG polyol with the polyester polyol and which use a small amount of the specific second chain extenders with the non-branched chain extender, meet the requirement of the invention, as is recited in claim 1.

The reference Ehrlich et al. ('904) teaches a polyurethane made from a diisocyanate (MDI), a polymeric diol (polyol) and an extender (chain extender), with equivalent proportions of the polyol to chain extender within the range of 1:2 to 1:20. Ehrlich et al.'s improvement is to replace at least 15 wt.% of the polyol polyester with a polyoxypropylene-polyoxyethylene (polyether) glycol or triol (2^{nd} polyol). The polyurethane of Ehrlich et al. are designed for injection molding applications (ski boots and the like). Ehrlich et al. also requires a certain level of ethylene oxide to be present in the polyol portion.

The disclosure of Ehrlich et al. is very broad as to the mixture of the two types of polyols (polyester and polyether). Column 3, lines 27-29, of Ehrlich states that the mixtures can be from 5% to 95% and from 95% to 5%. Applicants' claims recite that the polyether polyol be present from 5 to 20 weight % of the combined weight of polyols (polyester and polyether). The broad teaching of Ehrlich of mixing polyols do not help one solve the problem of the current invention.

Ehrlich et al. also discloses that a mixture of chain extenders can be used, but does not teach that one of the chain extenders must be a chain extender which is asymmetric or of a different chain length from the primary chain extender. Hereto, the disclosure of Ehrlich et al. is broad (up to 25 mole % of a second diol can be substituted for the straight chain diol) (see col. 3, lines 38-48 of Ehrlich et al.). Ehrlich et al. states that the second diol chain extender can be 0% and all of his examples show 0% of a second chain extender. In the current claims of the present application, the second diol chain extender, which is asymmetric or of a different chain length chain extender, and must be from 5 to 10 moles per 100 moles of the symmetrical chain

extender. A mere mixture of any chain extenders, would not give the desired results sought by this invention.

The present claims are further defined by the ratio of the molar percent of the co-chain extender to the weight percent of the polyether co-polyol. This feature is not taught by Ehrlich and could not be calculated from his range since his co-chain extender can be zero.

As noted by the Examiner, Ehrlich et al. does not mention using polyoxytetramethylene polyols and the use of thermoplastic polyurethanes for coated fabrics and conveyor belts. Ehrlich et al. requires the second polyol to be polyoxypropylene-polyoxyethylene glycol or triol, with a high content of ethylene oxide.

The reference van Der Wal et al. ('445) discloses a thermoplastic polyurethane which has a mixture of large amount of a polyester polyol with a small amount of polyether polyol. The preferred polyether polyol used by van Der Wal et al. is poly(tetramethylene ether) glycol. Van Der Wal et al. does not teach that one needs not only a mixture of polyols (polyester + polyether) but also a mixture of chain extender (a symmetrical and an asymmetric or different chain length), as recited in the current claims of Applicants. Applicants' control Examples 6 and 7 demonstrate that a mixture of 2 polyols with one chain extender do not give the desire results.

The reference Mao ('572) teaches a thermoplastic polyurethane made from (a) poly(oxypropylene)-poly(oxyethylene) polyol; (b) polyester polyol; (c) polyisocyanate; and (d) low molecular weight chain extender. Mao does not mention the use of poly(tetramethylene ether) glycol as a polyether polyol. Mao also does not teach that there needs to be a mixture of the chain extenders (a symmetrical and an asymmetric or different chain length).

The combination of the references Ehrlich et al. ('904), van Der Wal et al. ('445), and Mao (572) does not teach the specific thermoplastic polyurethane recited in Applicant's claims. Ehrlich et al. does not teach poly(tetramethylene ether glycol) as the polyol and does not require a co-chain extender (can be 0%). Van Der Wal et al. while teaching poly(tetramethylene ether glycol) does not teach that one needs a mixture of the two types of chain extenders as claimed by

Applicants. Mao, like Ehrlich et al. does not teach poly(tetramethylene ether glycol) as the polyether polyol nor a mixture of the specific chain extenders recited in Applicants' claims.

The combined teachings of the three references would not lead one skilled in the art to use a mixture of the specific chain extenders recited in the present claims. Although Ehrlich states that up to 25 mole percent of a second chain extender can be used, his examples are all one chain extender (1,4 butanediol) and Ehrlich does not teach that the chain extenders need to be a different type of compound. This fact coupled with the fact neither Van Der Wal nor Mao teach combining chain extenders would not suggest to one skilled in the art the present claimed invention. Also, the levels of the co-polyol and co-chain extender are very narrow and specific in the present invention, which is not taught by the combination of the references.

Both of the co-inventors of the present application were employees of the Assignee at the time the invention was made and both had an obligation to assign the invention to Assignee. Both inventors are still employees of Assignee.

It is submitted that the present claims are unobvious over the teachings of Ehrlich et al. in view of van Der Wal et al. and Mao. The Examiner is respectfully requested to reconsider and allow the amended claims.

Respectfully submitted,

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